TM 8-4110-001-24&P

TECHNICAL MANUAL

UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) REFRIGERATOR, MECHANICAL, BLOOD BANK 4110-01-117-3902

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HEADQUARTERS, DEPARTMENT OF THE ARMY
SEPTEMBER 1990

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER
3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL
4. SEND FOR HELP AS SOON AS POSSIBLE
5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *20 September 1990*

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You can help improve this manual. If you find any mistakes or if you know a way to improve procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 (Recommended Changes to Equipment Technical Publications) located in the back of this manual, to: Commander, U.S. Army Medical Materiel Agency, ATTN: SGMMA-M, Frederick, MD 21702-5001. A reply will be furnished directly to you.

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HOW TO USE THIS MANUAL

This manual provides all the information needed to understand the capabilities, functions, and characteristics of the refrigerator, mechanical, blood bank. It describes how to set up, operate, troubleshoot, repair and perform verification functions. You must familiarize yourself with the entire manual before operating or beginning a maintenance task.

The manual is arranged by chapters, sections, and paragraphs followed by appendixes, a glossary, an index, and DA Forms 2028-2. Use the table of contents to help locate the chapter or section for the general subject area needed. The index will help locate more specific subjects.

Multiple figures and tables are provided for your ease in using this manual.

Words that are both capitalized and in quotation marks are names of components or words that you will actually see on the equipment.

Chapter 3 contains a troubleshooting table that will enable you to identify malfunctions by observing light emitting diodes lamps and listening to the variations of the audible alarm.

Specific direct support and general support maintenance instructions are included. Only perform maintenance functions specified in the maintenance allocation chart for your level of maintenance. Maintenance functions specified for higher levels of maintenance frequently require additional training; test, measurement, and diagnostic equipment; or tools.

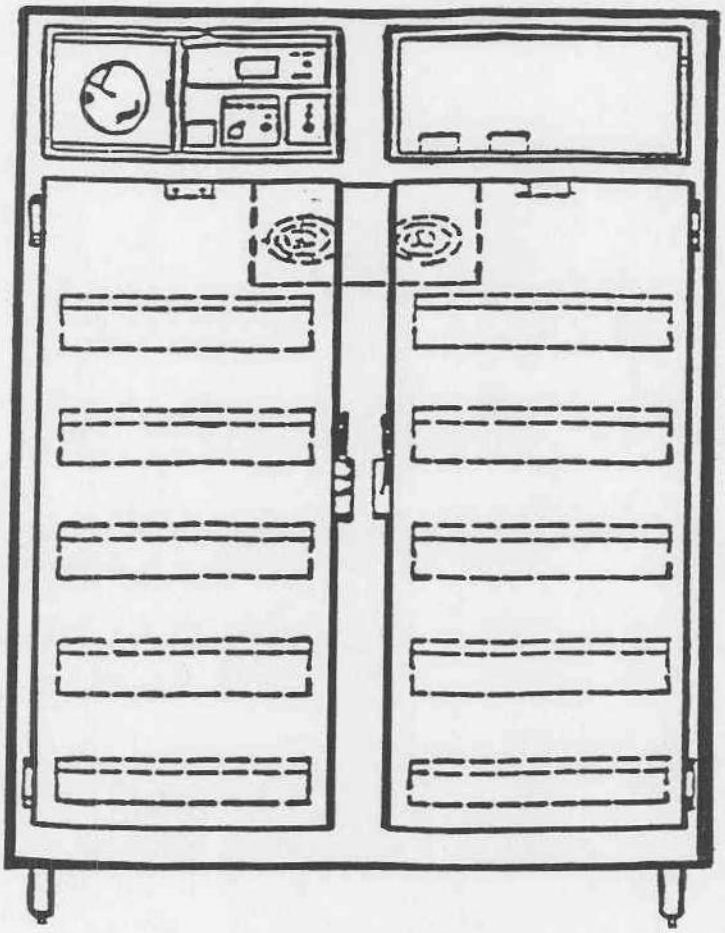


Figure 1-1. Refrigerator, mechanical, blood bank.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. Scope

This manual describes the refrigerator, mechanical, blood bank; provides users with standard data and orientation to the unit; and provides instruction for the performance of maintenance functions and services. Additional information follows:

a. Type of manual. Unit, direct support (DS), and general support (GS) maintenance (including repair parts and special tools list).

b. Model number and equipment name. BBR37SS-1B-03, refrigerator, mechanical, blood bank with recording thermometer and temperature surveillance module (fig 1-1).

c. Purpose of equipment. Provide storage and temperature control of blood for casualty care.

1-2. Explanation of abbreviations and terms

Special or unique abbreviations, acronyms, and symbols used within this manual are explained in the glossary.

1-3. Maintenance forms, records, and reports

Forms and procedures will be those prescribed by TB 38-750-2.

1-4. Destruction of Army materiel to prevent enemy use

Destruction and disposal of Army medical materiel will be in accordance with AR 40-61.

1-5. Preparation for storage or shipment

The requirements, including packaging and administrative storage, are in AR 40-61.

1-6. Quality assurance or quality control (QA/QC)

There is no pertinent QA/QC technical manual or bulletin for this equipment.

1-7. Nomenclature cross reference list

Official versus common usage nomenclatures are identified in table 1-1.

Table 1-1. Nomenclature cross-reference list.

Common name	*Official nomenclature*
Blood Refrigerator	Refrigerator, Mechanical, Blood Bank
Temperature Recorder	Recording Thermometer
Monitor	Temperature Surveillance Module

1-8. Reporting and processing medical materiel complaints/quality improvement reports

Medical materiel complaints and/or quality improvement reports for the blood refrigerator will be those prescribed by AR 40-61.

1-9. Warranty information

A warranty is not applicable.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-10. Equipment characteristics, capabilities, and features

a. Characteristics. The blood refrigerator is a self-contained unit of stainless steel interior and exterior construction. This unit includes removable/adjustable drawers, interior lighting, temperature controls, and a temperature recorder. The blood refrigerator will be shipped, stored, and used within an international standards organization (ISO) shelter.

b. Capabilities and features. The blood refrigerator operates from multiple voltages and frequencies. Its capacity is 480 pint-size plastic blood bags that can be maintained at a specified temperature. The blood refrigerator features dual-temperature controls, an automatic defrost system, vibration-free operation, and controlled internal air flow without stagnant air pockets. It also features a digital temperature display, monitor indicators, and an alarm for multiple parameters.

1-11. Data plate information

Data plate information is shown in table 1-2. Serial numbers will be different for each blood refrigerator.

Table 1-2. Data plate information.

4110-01-117-3902
REFRIGERATOR, MECHANICAL, BLOOD BANK
CONTRACT NO. DLA 120-87-C-8528
MODEL NO. BBR37SS-1B-03
SERIAL NO. XXXXXXXX
THE JEWETT REFRIGERATOR COMPANY

1-12. Performance data

Basic performance data is contained in table 1-3.

Table 1-3. Performance data.

Temperature range—2 to 4 degrees Celsius (36 to 40 degrees Fahrenheit)
Capacity—480 bags
Electrical voltage—115/230 volts AC
Frequency—50 to 60 Hertz (Hz)

1-13. Safety, care, and handling

a. Observe each WARNING, CAUTION, and NOTE in this manual. This equipment operates on 115 or 230 volts AC. Instructions pertaining to actions if someone is the victim of electrical shock are listed on page a of this manual.

b. This equipment should be cleaned often using luke-warm water and a good fungicidal detergent to eliminate airborne, low temperature-growing organisms. The drawers should also be wiped occasionally to prevent the accumulation of any foreign matter.

Section III. PRINCIPLES OF OPERATION

1-14. Basic refrigeration cycle

The following is a basic functional description of the refrigeration cycle.

a. Mechanical refrigeration is accomplished by continuously circulating, evaporating, and condensing a fixed supply of refrigerant in a closed system. Evaporation occurs at a low temperature and low pressure while condensation occurs at a high temperature and high pressure. Thus, it is possible to transfer heat from an area of low temperature (i.e., refrigerator cabinet) to an area of high temperature (i.e., ISO shelter).

b. Beginning the cycle at the evaporator inlet, the low pressure liquid expands, absorbs heat, and evaporates, changing to a low pressure gas at the evaporator outlet.

c. The compressor pumps this gas from the evaporator through the accumulator, increases its pressure, and discharges the high pressure gas to the condenser. The accumulator is designed to protect the compressor by preventing slugs of liquid refrigerant from passing directly into the compressor. An accumulator is normally included on all systems subjected to varying load conditions or frequent compressor cycling. In the condenser, heat is removed from the gas which then condenses and becomes a high pressure liquid.

d. As the high pressure liquid refrigerant enters the evaporator, it is subjected to a much lower pressure due to the suction of the compressor and the pressure drop across the capillary/drier assembly. Thus, the refrigerant tends to expand and evaporate. In order to evaporate, the liquid must absorb heat from the air passing over the evaporator.

e. Eventually, the desired air temperature is reached and the temperature control will break the electrical circuit and stop the compressor.

f. As the temperature of the air through the evaporator rises, the temperature control again closes the electrical circuit. The compressor starts, and the cycle continues.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. BLOOD REFRIGERATOR

2-1. General information

a. Move the blood refrigerator into the operating location, making sure that the bottom of the unit is evenly supported. A slight rocking or vibration may result when the compressor operates if the blood refrigerator sets on an uneven surface. This equipment has adjustable legs to compensate for uneven floors.

b. The operating location of the blood refrigerator must allow the rear of the mechanical compartment to be unobstructed for ventilation of the condensing unit.

CAUTION

A minimum of 8 inches clearance is required between the ceiling and the top of the blood refrigerator to allow for adequate ventilation. A minimum of 3 inches rear clearance is required.

c. The hermetically sealed condensing unit is shipped with all service valves open and ready for operation. Do not adjust valves unless servicing the unit.

2-2. Start-up procedures

a. Determine the voltage and frequency of the available electrical outlet or junction box.

NOTE

The electrical outlet or junction box should be within 6 feet of the condensing unit compartment.

b. Locate the electrical transformer of the blood refrigerator and adjust the internal electrical connectors in accordance with table 2-1.

Table 2-1. Electrical connections.

110V/50 Hz — A to	5
B to	6
110V/60 Hz — A to	6
B to	6
220V/50 Hz — A to	3
B to	6
220V/60 Hz — A to	3
B to	5

WARNING

Do not open the cover of the transformer when the unit is connected to electrical power.

c. Connect the unit to electrical power.

2-3. Operation of the blood refrigerator

a. Turn the dial knob clockwise to the on position.

b. The condensing unit will operate and begin to cool the storage compartment. The cooling coil fan will operate continuously.

NOTE

Dual temperature controls are factory set to operate on 2 to 4 degrees Celsius (36 to 40 degrees Fahrenheit) air temperature. Refer to chapter 3, section IV of this manual for temperature adjustment or verification procedures.

c. The temperature is adjusted by turning the temperature control dial knob clockwise for colder operation and counterclockwise for warmer operation. Turn the dial knob ¼ space at a time and allow 2 hours of operation for the internal temperature to balance prior to further adjustment.

d. Determine that the door is closed by observation, physical inspection, and operation of the open door indicator lamp and audible alarm.

e. Observe the monitor light emitting diode (LED) lamp indicating high temperature. Disregard for initial start-up until sufficient cooling time has elapsed.

Section II. MONITOR

2-4. General information

a. The monitor module is a precision electronic instrument. The module is designed to be a separate and distinct subsystem which operates and functions independently from the blood refrigerator control subsystem.

b. Five basic functions performed by the module are—

(1) Surveillance of temperature within the blood refrigerator cabinet on a 24-hour basis.

(2) Display of blood temperature with provision for the user to select and momentarily display the temperature in another location within the refrigerator cabinet.

(3) Display of primary power status.

(4) Surveillance of door positions.

(5) Surveillance of battery condition.

NOTE

The monitoring of these five key functions and the automatic warning and specific identification of a malfunction permit immediate corrective action be taken by responsible persons to eliminate dangerous and costly stored blood spoilage.

2-5. Start-up procedures

a. Refer to the connection diagram in figure 2-1. Remove the sensor from the 8-ounce plastic bottle in the upper blood refrigerator cabinet interior. Fill the bottle with a 10 percent glycerol in water solution. Insert the sensor into the bottle, making certain that it is immersed into the liquid until the solution is within ½-inch of the top of the bottle.

NOTE

To reduce evaporation of liquid, seal the bottle opening with the plastic cover provided.

b. Remove the sensor from the plastic bottle in the lower blood refrigerator cabinet interior and follow the preceding instructions.

c. Connect standby battery (9 V DC) (located on top of the module rear protective/dust cover) by clipping the polarized wiring adaptor to the battery terminals.

d. The module is now electrically and mechanically installed.

2-6. Operation of the monitor module

The monitor module face panel has three sections entitled "SURVEILLANCE MODULE," "MONITOR," and "DOOR AJAR."

a. Surveillance module section. With the "ON/OFF" switch in the normal "ON" position, the digital display indicates the temperature of the upper solution within the refrigerated cabinet and the green LED "UPPER SOLUTION" lamp is illuminated. To display the lower solution temperature, depress the"LOWER SOLUTION" push button switch. The instrument now senses and momentarily displays the lower solution temperature within the lower section of the cabinet. This mode of operation is indicated by the extinguishing of the green LED "UPPER SOLUTION" lamp and illumination of the green LED "LOWER SOLUTION" lamp. After momentary display, the unit automatically returns to displaying the upper solution temperature.

b. Monitor section. This section (which is the heart of the module) monitors the temperature of the upper solution within the blood refrigerator cabinet and the presence or absence of primary power. The temperature monitoring is performed by thermistor sensors. This section also includes the audible alarm, a "BATTERY TEST" switch, and a timed alarm silencing switch. With all conditions safe, the green LED temperature "SAFE" lamp is illuminated and the green LED power "ON" lamp is illuminated. To perform a battery test, actuate the "BATTERY TEST" switch. This will cause the extinguishing of all display indications and the flashing of the red LED power "FAILURE" lamp; the alarm will emit a pulsing sound.

c. Door position section. This section consists of a red LED door "AJAR" lamp, a "SILENCE/RESET" push-button switch, and a fuse. When the blood refrigerator door is properly closed, no indication is present. Whenever the door is open the red LED door "AJAR" lamp will flash. If the door remains open for approximately 3 minutes (± 30 seconds), an alarm will be heard. If it is necessary for the door to remain open after the audible alarm sounds, depress the door alarm "SILENCE/RESET" push button switch and the audible alarm will be silenced for an additional 3 minutes. To reset the alarm function, momentarily depress the "SILENCE/RESET" push button switch.

d. Alarm condition. When an unsafe condition occurs, the monitor section sounds an alarm and identifies the type of failure. The alarm will sound when—

(1) The upper solution temperature becomes unsafe (either too high or too low). When an unsafe temperature occurs, the green LED "SAFE" temperature lamp is extinguished and the

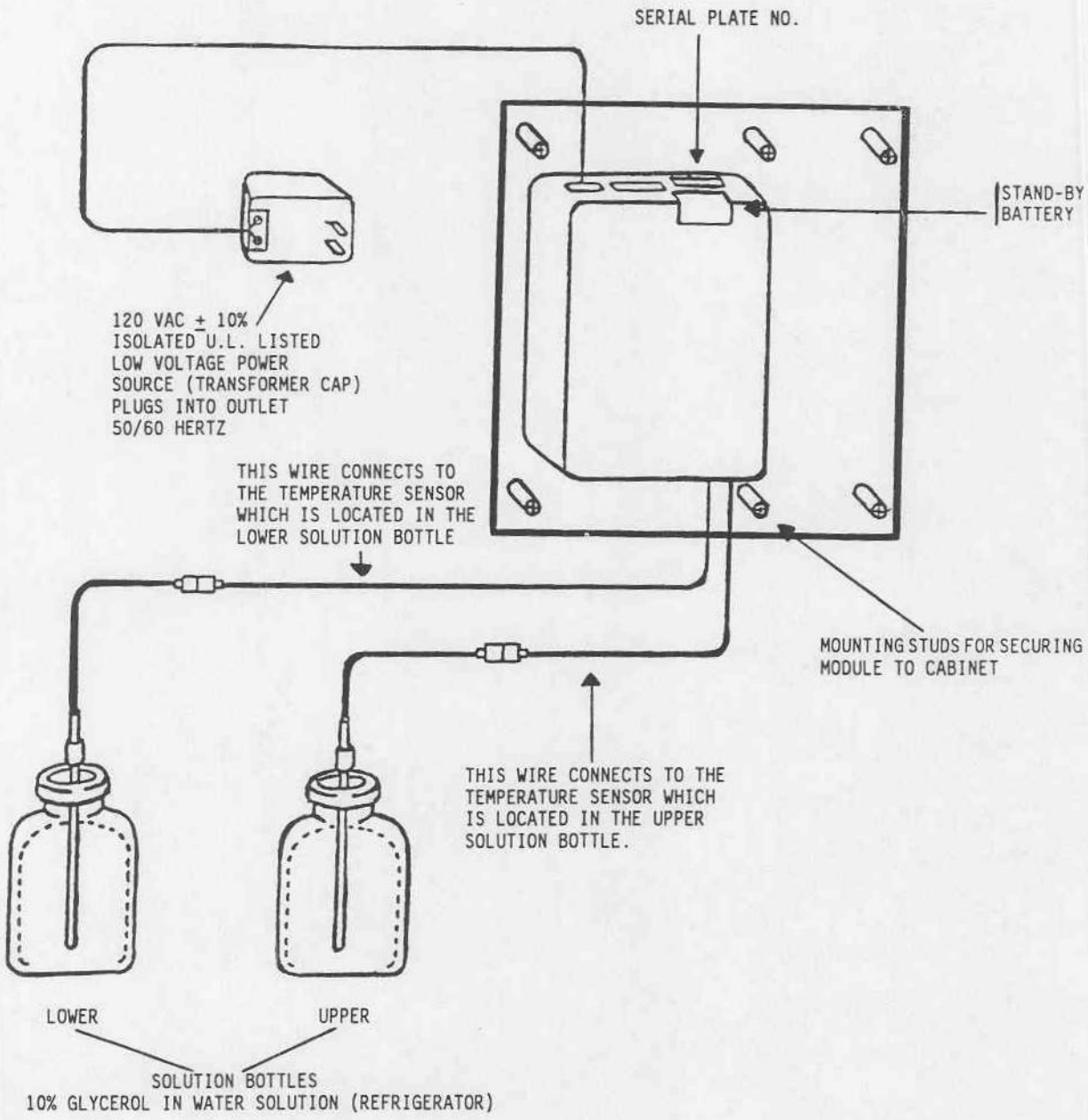


Figure 2–1. Monitor connections.

appropriate red LED lamp, "HIGH" or "LOW," is illuminated indicating the nature of the temperature alarm. The alarm emits a continuous sound. The audible output may be silenced for a period of "0" to "45" "MINUTES" by setting the silence timer and then moving the switch to "START." When the temperature returns to a safe condition, the module automatically indicates a safe condition.

(2) The primary power source to the blood refrigerator fails. The green LED power "ON" lamp is extinguished, the red LED power "FAILURE" lamp flashes, and the alarm emits a pulsing sound. The alarm can be silenced by the timed alarm switch. When power is restored, the module automatically indicates a safe condition.

e. Low battery condition. When the stand-by battery requires replacement, a pulsing audible alarm will sound and the power "FAILURE" LED lamp will be illuminated. (The power "ON" LED lamp will be on.)

Section III. TEMPERATURE RECORDER

2-7. General information

a. The recorder is a sensitive and specifically designed instrument for keeping permanent Celsius temperature records. It is designed to provide uninterrupted monitoring of stored blood temperature.

b. The 7-day spring-wound instrument has a continuous-flow ink system. Each fiber-tipped pen has its own sealed ink supply and provides up to 8 months of fine-line temperature recording. The ink supply is specially formulated to ensure continuous flow without skipping or blotting. The flexible stainless steel pen arm easily inserts into the pen and is attached to the recording thermometer by two screws. A temperature sensitive, stainless steel, encapsulated sensor is immersed in liquid. In the event of a power failure, there is a complete record of the increase in temperature while the power is off, as well as the decrease in temperature when the power is restored.

2-8. Start-up procedures

a. Pen lifter. A pen lifter is provided to raise the pen off the chart whenever required. The pen is raised by pulling on the metal tab located at the upper left-hand corner of the chart plate. The pen is lowered by depressing the tab.

b. Charts. Raise the pen lifter as far as possible. This will provide approximately ½ inch of clearance for installing/removing charts. Unscrew the knob at the center of the chart. Position the new chart so that the correct time line coincides exactly with the red pointer on the chart plate. Replace the chart knob and screw it tightly against the new chart.

NOTE

A small dot of ink appearing where the pen point touches the chart will indicate that the pen will trace properly.

c. Chart drive. Wind the mechanical chart drive each time the chart is changed. With the chart removed, insert the winding key through the hole in the chart plate and wind the arbor in the direction indicated by the arrow on the chart plate. An observation cutout has been provided in the chart plate to observe the balance wheel to ascertain that the chart drive is operating. Be sure the "ON/OFF" switch located under the chart plate is in the on position.

CAUTION

Do not overwind.

NOTE

If the chart does not start after winding, reinsert the key and release it quickly after winding the chart drive fully. Repeat if necessary.

d. Ink pen. The pen consists of a self-contained ink reservoir with a porous plastic stylus which is slipped firmly onto the outboard end of the pen arm. Two screws are provided at the upper end of the pen arm to provide adjustment of its length so that the pen tracks the time line on the chart. Check this after each replacement of the pen and adjust accordingly. Remove the colored cap. If the stylus does not quite touch the chart, adjustment can be made by slightly bending the pen arm in the center. Do not use more pressure than necessary to make a fine line.

NOTE

As the ink supply nears exhaustion, the ink color becomes lighter. This indicates that the pen should be replaced.

e. Chart plate.

(1) To remove the chart plate, insert index fingers into the openings at the lower left- and right-hand corners of the chart plate. Press upward against the top of the spring loaded chart plate posts with thumbs and lift the chart plate off the posts. Push the chart towards the top of the recorder and remove it.

(2) To replace the chart plate, position the openings at the upper edge of the chart plate on the upper chart plate posts. This will place the chart plate correctly over the lower plate posts. Then snap it into position by depressing the lower edge.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-9. Environment

a. The nature and use of this blood refrigerator is such that its operation should not involve unusual situations. It should be used within an ISO shelter.

b. Use of the blood refrigerator in unheated areas below 60 degrees Fahrenheit (16 degrees Celsius) may require a low temperature compressor protection kit for proper operation.

CHAPTER 3

UNIT-LEVEL MAINTENANCE

Section I. GENERAL INFORMATION

3-1. Overview

Maintenance functions, both preventive and corrective, that are beyond the scope of the user are assigned to unit-level medical equipment maintenance personnel. Unit-level maintenance personnel will perform the majority of maintenance required for the blood refrigerator except for tasks involving the compressor and cabinet. This chapter provides instructions and information to aid in performing the required tasks.

3-2. Lubrication instructions

Lubrication is not required. The motors are permanently lubricated.

3-3. Tools and test equipment

Common tools and test equipment required for unit-level maintenance are listed in appendix B, section III of this manual.

3-4. Expendable supplies

Expendable supplies and materials required for unit-level maintenance are listed in appendix C, section II of this manual.

3-5. Special tools

Special tools required for unit-level maintenance are listed in appendix D, section III of this manual.

3-6. Repair parts

Repair parts required for unit-level maintenance are listed in appendix D, section II of this manual.

Section II. MAINTENANCE PROCEDURES

3-7. General

a. Clean the finned condensing unit in the top of the cabinet periodically to preclude blockage by lint and other foreign substances in the air. A small test tube brush is ideal for this task.

WARNING

The blood refrigerator is equipped with electric condensate evaporators located on the back of the cabinet. Avoid contact with the heating elements when the blood refrigerator is running.

b. Conduct a complete operational test at least annually. Replace all damaged or unserviceable components.

c. Perform electrical fault location/troubleshooting using the electrical schematic provided in figure 3-1.

d. Clean grease and other deposits from the fans, fan guards, and the drain pan at least annually.

Section III. MECHANICAL SERVICES AND ADJUSTMENTS

3-8. Door gaskets

Replacement of the door gaskets is performed using the procedures listed in table 3-1.

Table 3-1. Door gasket replacement procedures.

1. Remove the door(s) from the blood refrigerator and place them on a flat work surface to ease removal of the unserviceable gasket and installation of a new gasket.
2. Remove the screws holding the inner door metal and gasket.
3. Mark the position of the door metal to assure proper alignment when replacing the gasket.
4. Remove the door metal and the unserviceable gasket.
5. Install a new gasket, slide the inner door metal into position, and align the screw holes. Adjust the gasket to fit within the edge of the exterior door pan.
6. Replace the screws removed in step 2 above.
7. Reinstall the door(s) on the blood refrigerator and check for ease of operation and proper gasket seal. Adjust as required.

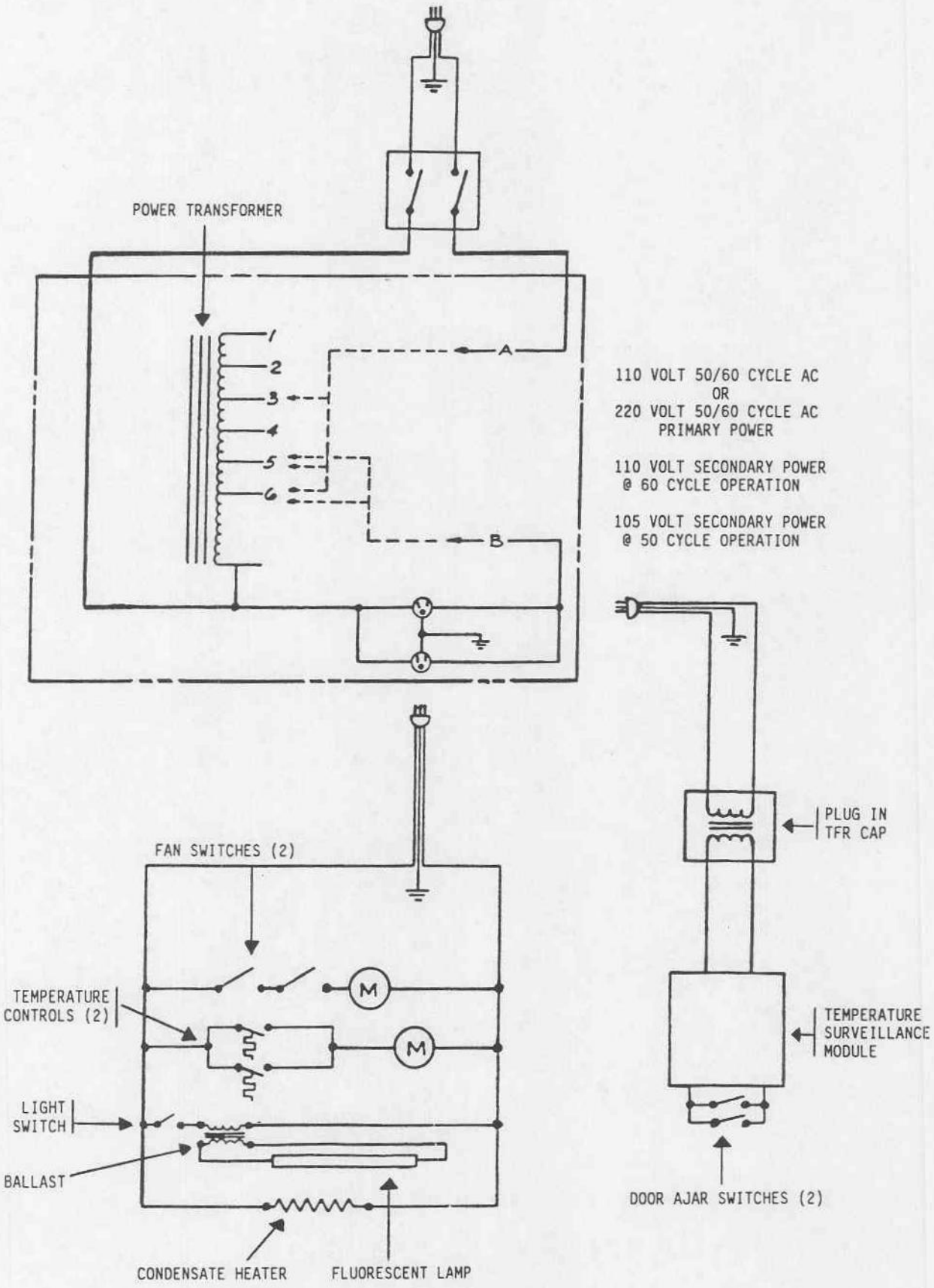


Figure 3-1. Electrical schematic.

3-9. Hinges

Hinge adjustments are performed by following the detailed instructions and illustrations in figure 3-2.

3-10. Latches and strikes

Latch and strike adjustments are performed by following the detailed instructions and illustrations in figure 3-3.

3-11. Drawers

The sliding drawers are installed or removed by following the detailed instructions and illustrations in figures 3-4 and 3-5.

HINGE ADJUSTMENT

1. Remove the exterior hinge cover plate (A) by opening the refrigerator door. Place the screwdriver under interior portion of cover, gently pry cover outward. Pull straight out. Close door.

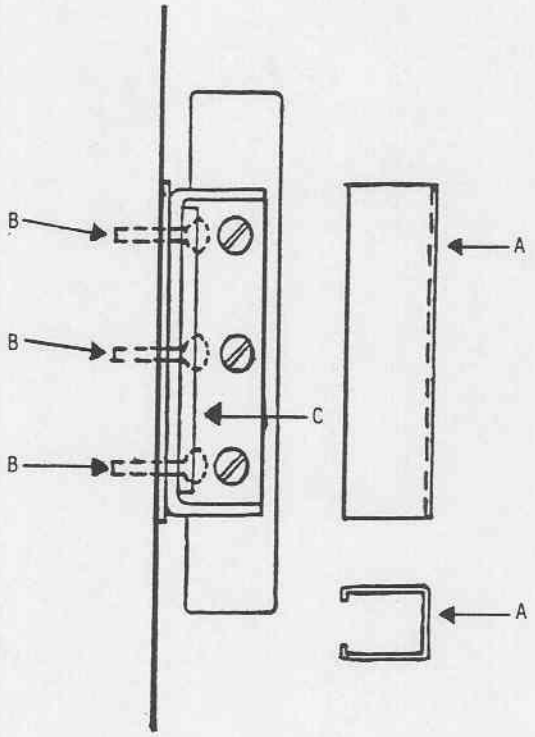
2. Loosen the three screws (B) which hold adjusting plate (C) in position.

3. To tighten gasket seal, place hand against exterior of door near hinges, gently press in on door so gasket sits firmly against cabinet face. Tighten screws (B).

4. The door will tend to spring open if the gasket seal was adjusted too tight. Readjust, as necessary.

5. Open the door and insert a dollar bill (or a piece of paper of similar size) between the door gasket and cabinet. Pull gently and a slight resistance should be felt by removal of the dollar bill. If the door latch is loose, refer to the next paragraph for adjustment of the latch.

6. Replace cover plate (A).



NOTE

To accomplish different offsets, shims are utilized. If replacing hinges, make sure to reuse any shims furnished on cabinet.

Figure 3-2. Hinge adjustment.

LATCH AND STRIKE ADJUSTMENT

1. Latch (A) adjustment (up or down) is started by loosening the mounting screws (B).

2. Strike plate (C) remains in position.

3. Move the strike plate (D) up or down as required and retighten the screws (B) when the adjustment is satisfactory.

4. The latch (A) adjustment (in or out) is accomplished by loosening screw (E).

5. Adjust the strike plate (D) in or out as required for proper gasket seal and retighten screw (E).

NOTE

This stainless steel hex head cap screw requires a box wrench or open end wrench. Do not use pliers.

If replacing the latch and strike assembly, make sure to reuse any shims.

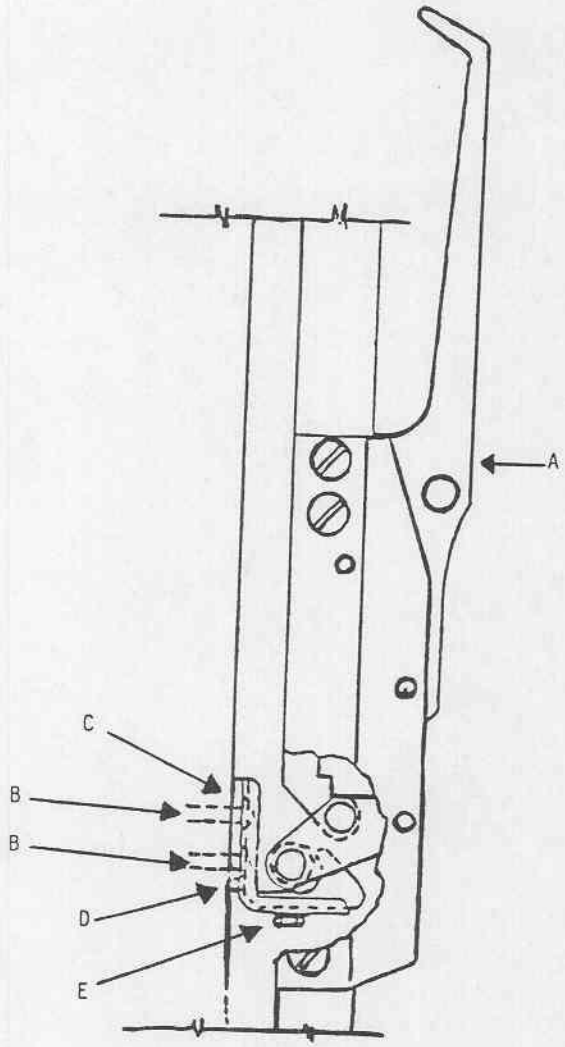
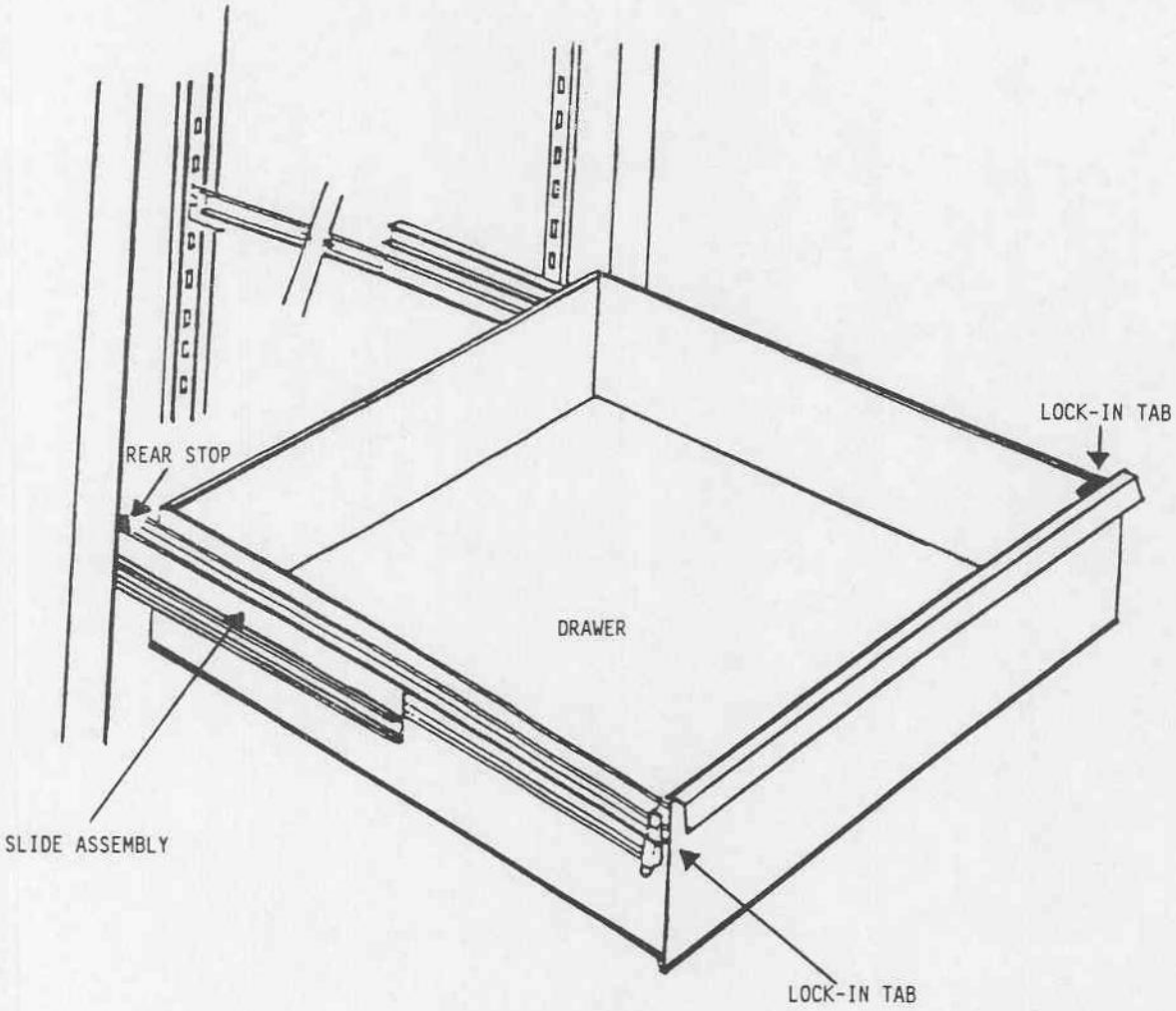


Figure 3-3. Latch and strike adjustment.



Removing Drawer

1. Press lock-in tabs inward towards drawer side.
2. Lift front of drawer up and pull clear of slides.

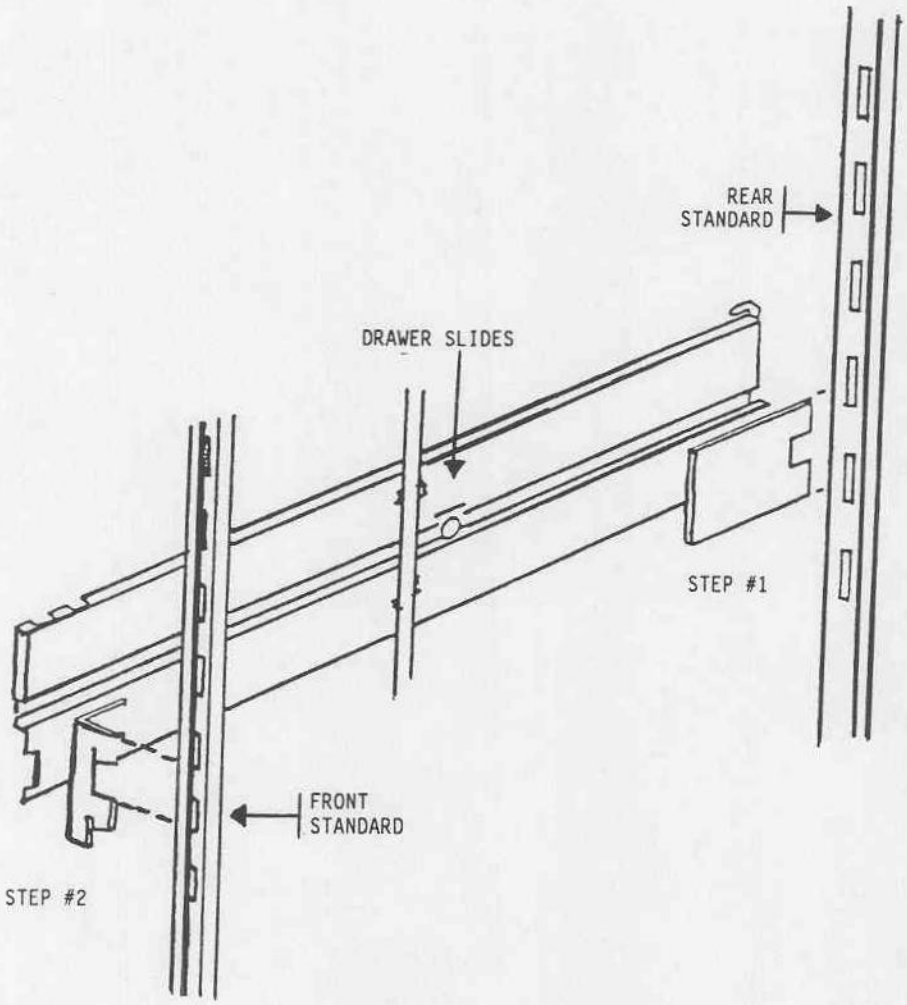
Installing Drawer

1. Place drawer on top of sides and push into rear stops.
2. Align slot in drawer slide with lock-in tabs and press in place.

NOTE

Lock-in tabs must be fully engaged in slots, otherwise door pan may be damaged.

Figure 3-4. Removal and installation of drawer.



SLIDE MOUNTING INSTRUCTIONS

Step #1. Push into slots in rear standard. Make certain that opposite drawer slides are in the same slots in the opposite standards.

Step #2. Push into slots in front standard and press down. If necessary, tap into place.

Figure 3-5. Drawer slide mounting instructions.

Section IV. VERIFICATION

3-12.

The monitor operation is verified using the procedures listed in table 3-2.

Table 3-2. Monitor verification.

1. Operate the blood refrigerator for a minimum of 30 minutes.
2. Insert the 10 degrees Celsius plug onto the end of the upper solution thermistor cable.
3. Disconnect the door ajar remote connection.
4. Disconnect the battery.
5. Remove the control cover (four screws).
6. Reconnect the door ajar remote connection and the battery.
7. Adjust potentiometer number R6 for a reading of 10 degrees Celsius, if required.
8. Remove the calibration plug from the upper solution thermistor cable and reconnect the upper thermistor.
9. Disconnect the door ajar remote connection and the battery.
10. Replace the rear cover.
11. Reconnect the door ajar remote connection and the battery.

Figure 3-6 provides the arrangement of components as viewed from the rear with the cover removed.

3-13. Temperature recorder

The temperature recorder is verified using the procedures in table 3-3.

Table 3-3. Temperature recorder verification procedures.

1. Operate the blood refrigerator and temperature recorder for a minimum of 48 hours.
2. Place the bulb of a test thermometer alongside the temperature bulb of the recorder in a well agitated liquid bath.
3. Compare readings after 5 minutes. If the recorder does not check with the test thermometer, correct the problem by adjusting the screw at the upper right of the pen arm.

3-14. Temperature controls

a. The temperature controls use a single pole switch with a snap action toggle that "opens" or "closes" the electrical circuit as temperature increases or decreases. The temperature control dial knob is off in the fully counterclockwise position.

b. Rotation of the dial knob changes the electrical "cut-out" or switch open position but does not change the "cut-in" or switch closed position.

c. The blood refrigerator temperature controls are verified using the procedures listed and illustrated in figure 3-7.

NOTE

Perform the procedures in table 3-3 when the temperature range of 2 to 4 degrees Celsius (36 to 40 degrees Fahrenheit) cannot be obtained by adjusting the dial knob.

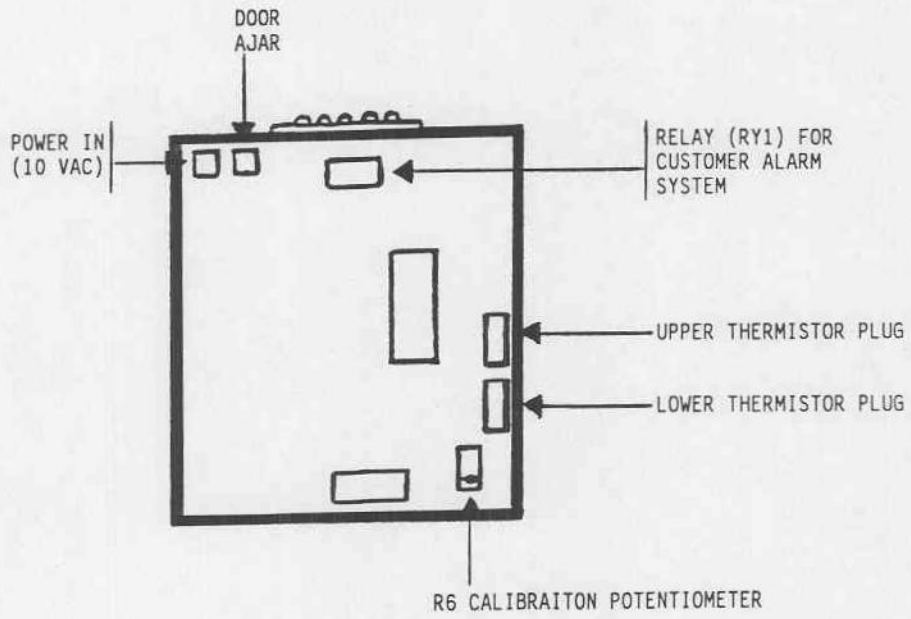


Figure 3-6. Monitor component arrangement, rear view (cover removed).

1. Turn the dial knob of one control to the "OFF" position.

2. Turn the dial knob of the second control to the number "6" position.

NOTE

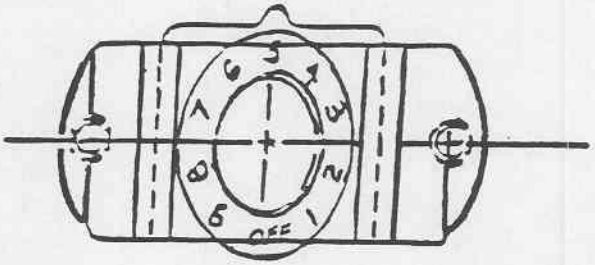
The "CUT-IN" and "CUT-OUT" screw adjustments are independent. Adjustments should be made in ¼-turn increments.

3. Adjust the "CUT-IN" screw of the second control to start the compressor at 4 degrees Celsius (40 degrees Fahrenheit) air temperature.

4. Adjust the "CUT-OUT" screw of the second control to stop the compressor at 2 degrees Celsius (36 degrees Fahrenheit).

5. Allow the compressor to cycle several times.

6. Adjust the control initially turned "OFF" in step 1 by following the step sequence again.



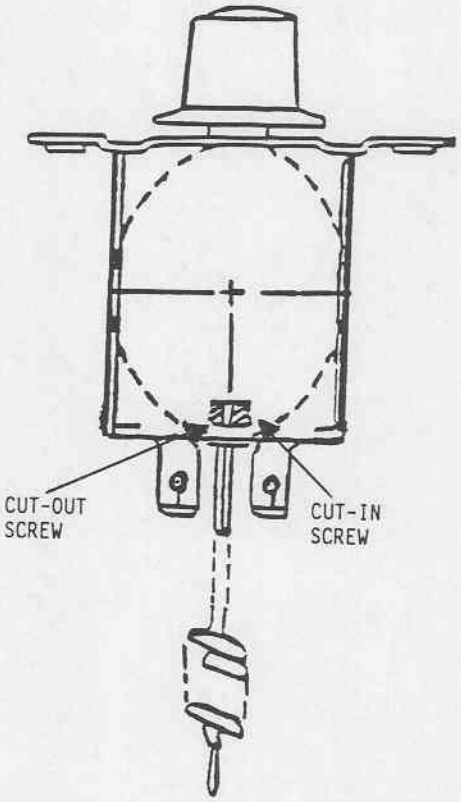


Figure 3-7. Temperature control(s) adjustments.

Section V. TROUBLESHOOTING

3-15. General

a. General troubleshooting information for locating and correcting many of the operating malfunctions which may develop in the blood refrigerator are listed in table 3-4. This table lists the common malfunctions which you may find during the operation or maintenance of the blood refrigerator. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests and corrective actions. If a malfunction is not listed or is not determined by routine diagnostic procedures, notify your appropriate maintenance support unit.

Table 3-4. General troubleshooting.

SYMPTOM
POSSIBLE CAUSE
CORRECTIVE ACTION

1. COMPRESSOR WILL NOT START; NO HUM.
   - Line switch open.
     - Close switch; test/replace switch.
   - Fuse removed or blown.
     - Replace fuse.
   - Overload protector tripped.
     - Test and replace, if required.
   - Control stuck in open position.
     - Test, repair, or replace control.
   - Control off due to cold location.
     - Adjust control.
   - Wiring improper or loose.
     - Check wiring against diagram and repair.
2. COMPRESSOR WILL NOT START; HUMS, BUT TRIPS ON OVERLOAD PROTECTOR.
   - Low voltage to unit.
     - Troubleshoot electrical circuit and correct.
   - Starting capacitor defective.
     - Replace capacitor.
   - Relay failing to close.
     - Determine reason and correct; replace if necessary.
   - Compressor motor has a winding open or shorted.
     - Replace compressor.
   - Internal mechanical trouble in compressor.
     - Replace compressor.
   - Improperly wired.
     - Check wiring against diagram and repair.
3. COMPRESSOR STARTS, BUT DOES NOT SWITCH OFF FROM START WINDING.
   - Low voltage to unit.
     - Troubleshoot electrical circuit and correct.
   - Relay fails to open.
     - Determine reason and repair or replace relay.
   - Run capacitor is defective.
     - Replace run capacitor.
   - Excessively high discharge pressure.
     - Check discharge shut-off valve for possible overcharge or insufficient cooling of the condenser.
   - Compressor motor has a winding open or shorted.
     - Replace compressor.
   - Internal mechanical trouble in compressor (tight).
     - Replace compressor.
   - Improperly wired.
     - Check wiring against diagram and repair.
4. COMPRESSOR STARTS AND RUNS, BUT SHORT CYCLES ON OVERLOAD PROTECTOR.
   - Excessive discharge pressure.
     - Assure adequate ventilation and remove restrictions in refrigeration lines.
   - Low voltage to unit.
     - Troubleshoot electrical circuit and correct.
   - Overload protector defective.
     - Replace protector.
   - Run capacitor defective.
     - Replace capacitor.
   - Compressor too hot; return gas hot.
     - Check refrigerant charge; fix leak; add refrigerant, as required.
   - Suction pressure too high.
     - Check refrigeration cycle.
   - Compressor motor has a winding shorted.
     - Replace compressor.
   - Excessive current passing through overload protector.
     - Check wiring diagram; check possible incorrect connection of fan motors, lamps, or heater, and correct.
5. UNIT RUNS OK, BUT SHORT CYCLES.
   - Overload protector.
     - Replace defective protector.
   - Thermostat.
     - Adjust differential.
   - High pressure cut-out due to insufficient circulation.
     - Check air supply to condenser; correct problem.
   - High pressure cut-out due to refrigerant overcharge.
     - Reduce charge.
   - High pressure cut-out due to air in system.
     - Purge air from system; add refrigerant, as required.
   - Low pressure cut-out due to liquid line solenoid leaking.
     - Repair line.
   - Low pressure cut-out due to compressor valve leak.
     - Replace valve.
   - Low pressure cut-out due to undercharge.
     - Fix leak, add refrigerant.
   - Low pressure cut-out due to restriction in expansion device.
     - Replace device.
6. UNIT OPERATES LONG OR CONTINUOUSLY.
   - Shortage of refrigerant.
     - Fix leak; add refrigerant.
   - Control contacts stuck or frozen.
     - Clean contacts or replace control.
   - Refrigerated or air-conditioned space has excessive heat load or poor insulation.
     - Determine fault and correct.
   - Dirty condenser.
     - Clean condenser.
   - Evaporator coil iced.
     - Defrost. Check defrost circuit.
   - Restriction in refrigeration system.
     - Determine location and remove.
   - Filter dirty.
     - Clean or replace filter.
7. START CAPACITOR OPEN, SHORTED, OR BLOWN.
   - Relay contacts do not open properly.
     - Clean contacts and replace relay, if required.
   - Prolonged operation on start cycle due to low voltage to unit.
     - Troubleshoot electrical circuit and correct.
   - Prolonged operation on start cycle due to improper relay.
     - Replace relay.
   - Prolonged operation on start cycle due to high starting load.
     - Correct by using pump down arrangement, if necessary.
   - Excessive short cycling.
     - Determine reason for short cycling and correct.
   - Improper capacitor.
     - Determine correct size and replace.
8. RUN CAPACITOR OPEN, SHORTED, OR BLOWN.
   - Improper capacitor.
     - Determine correct size and replace.
   - Excessively high line voltage (110% of rated maximum).

Section IV. REMARKS FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) REFERENCE CODE	(2) REMARKS
A	Provided to indicate the category responsible for PMCS and the man-hour requirement. Where Medical Equipment Repairers are not authorized, the appropriate command(s) will designate responsibility for PMCS.
B	Performance will be accomplished by support-level maintenance for units without organic capability.
E	Special tool(s) required. Refer to Appendix D.

Table 3-4. General troubleshooting—Continued.

SYMPTOM
POSSIBLE CAUSE
CORRECTIVE ACTION

Determine reason and correct.

9. RELAY DEFECTIVE OR BURNED OUT.
   Line voltage too high or too low.
   Determine reason and correct.
   Excessive short cycling..
   Determine reason for short cycling and correct.
   Incorrect relay.
   Check and replace relay.
   Incorrect mounting angle.
   Remount relay in correct position.
   Relay being influenced by loose or vibrating mounting.
   Remount rigidly.
   Incorrect run capacitor.
   Replace with proper capacitor.
10. SPACE TEMPERATURE TOO HIGH.
   Control setting too high.
   Reset control.
   Environmental control unit (ECU) temperature too high.
   Adjust ECU.
   Inadequate air circulation.
   Improve air movement.
11. SUCTION LINE FROSTED OR SWEATING.
   Expansion valve passing excess refrigerant.
   Replace valve.
   Expansion valve stuck open.
   Replace valve.
   Evaporator fan not running.
   Test fan motor; replace fan motor, if required.
   Overcharge of refrigerant.
   Correct charge.
12. LIQUID LINE FROSTED OR SWEATING.
   Restriction in filter drier.
   Replace filter drier.
   Liquid shut-off (king valve) partially closed.
   Open valve fully.
13. UNIT NOISY.
   Loose parts or mountings.
   Find loose parts or mountings and tighten.
   Tubing rattling.
   Reform tubing so that it is free of contact..
   Bent fan blade causing vibration.
   Replace blade.
   Fan motor bearing worn.
   Replace bearings or motor, if required.
14. UNIT COOLS BUT DOES NOT GET TO SET POINT.
   Fan not operating.
   Check fan motor; check circuits; replace motor, if required.
15. "SURVEILLANCE MODULE" "UPPER SOLUTION" LED LAMP OFF; DISPLAYED TEMPERATURE CORRECT.
   LED lamp defective.
   Replace LED lamp.
   LED circuit defective.
   Determine reason and correct.
16. "SURVEILLANCE MODULE" "LOWER SOLUTION" LED LAMP OFF WHEN "SELECTION PUSHBUTTON SWITCH" DEPRESSED; DISPLAYED TEMPERATURE CORRECT.
   Switch defective.
   Test and replace, if required.
   LED lamp defective.

Table 3-4. General troubleshooting—Continued.

SYMPTOM
POSSIBLE CAUSE
CORRECTIVE ACTION

Replace LED lamp.
LED circuit defective.
Determine reason and correct.

17. "SURVEILLANCE MODULE" DISPLAYED TEMPERATURE INCORRECT; LED LAMPS ON OR OFF AND "SELECTION PUSHBUTTON SWITCH" NOT DEPRESSED OR DEPRESSED MOMENTARILY.
   Upper/lower solution sensor disconnected.
   Check and reconnect sensor.
   Upper/lower solution sensor defective.
   Replace sensor(s).
   Upper/lower solution circuit malfunction.
   Determine reason and correct.
   Digital temperature display defective.
   Replace display.
18. DOOR STATUS LED LAMP CONSTANTLY ON OR FLASHING AND "MONITOR" SECTION AUDIBLE ALARM CONSTANTLY ON OR PULSING; DOOR CLOSED.
   "RESET" switch defective.
   Replace switch.
   Door switch(es) defective.
   Replace switch(es).
   Switch circuits defective.
   Determine reason and correct.
19. DOOR STATUS LED LAMP CONSTANTLY ON OR FLASHING; NO AUDIBLE ALARM; DOOR OPEN.
   "SILENCE/RESET" switch defective.
   Replace switch.
   Switch or audible alarm circuits defective.
   Determine reason and correct.
   Audible alarm defective.
   Perform other tests involving alarm and replace, if required.
20. DOOR STATUS LED LAMP OFF; "MONITOR" SECTION AUDIBLE ALARM OPERATING CORRECTLY; DOOR OPEN.
   LED lamp defective.
   Replace lamp.
   Circuit defective.
   Determine reason and correct.
21. "MONITOR" "TEMPERATURE" LED "SAFE" LAMP ON; "POWER" "ON" LED LAMP ON; "POWER" "FAILURE" LED LAMP FLASHING; AUDIBLE ALARM PULSING.
   Battery condition low.
   Replace battery.
22. "MONITOR" "TEMPERATURE" LED LAMPS OFF; "POWER" "ON" LED LAMP ON; "POWER" "FAILURE" LED LAMP OFF; AUDIBLE ALARM OFF.
   "Monitor" "temperature" LED lamp(s) defective.
   Replace lamp(s).
   Circuit defective.
   Determine reason and correct.
23. "MONITOR" "TEMPERATURE" LED LAMPS ON; "POWER" "ON" LED LAMP ON; "POWER" "FAILURE" LED LAMP OFF; AUDIBLE ALARM OFF.
   Circuit(s) defective.
   Determine reason and correct.

Table 3-4. General Troubleshooting—Continued.

SYMPTOM POSSIBLE CAUSE CORRECTIVE ACTION
24. "MONITOR" "TEMPERATURE" LED "SAFE" LAMP OFF; "POWER" "ON" LED LAMP OFF; "POWER" "FAILURE" LED LAMP FLASHING; AUDIBLE ALARM PULSING.
"BATTERY TEST" switch in off (down) position. Place in on (up) position.

CHAPTER 4

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

Section I. GENERAL INFORMATION

4-1. Overview

This chapter provides for the accomplishment of corrective maintenance that is beyond the capability, capacity, and authorization for unit-level maintenance personnel. The procedures in this chapter should not be attempted at the unit level.

4-2. Reparable exchange component(s)

The components or assemblies identified in appendix B, section II, are only authorized for servicing by support-level maintenance units. The main printed circuit board identified by group number 1112 will be serviced by medical units and the other components or assemblies will be serviced by the appropriate commodity-oriented support units.

Section II. TROUBLESHOOTING

4-3. General

There are no specific troubleshooting procedures beyond the unit-level procedures at these levels of maintenance.

APPENDIX A

REFERENCES

A-1. Army Regulations

AR 40-61	Medical Logistics Policies and Procedures
AR 710-2	Supply Policy Below the Wholesale Level
AR 725-50	Requisitioning, Receipt, and Issue System
AR 750-1	Army Materiel Maintenance Policies
AR 750-2	Army Materiel Maintenance Wholesale Operations
AR 750-43	Test, Measurement, and Diagnostic Equipment (TMDE)

A-2. Technical Manual

TM-DPSC-6500-RPL	Medical Repair Parts Reference List

A-3. Technical Bulletins

TB 38-750-2	Maintenance Management Procedures for Medical Equipment
TB 43-180	Calibration and Repair Requirements for the Maintenance of Army Materiel
TB 750-8-1	Maintenance Expenditure Limits for Medical Equipment Federal Supply Groups (Medical Only)

A-4. Supply Bulletins

SB 700-20	Army Adopted/Other Items Selected for Authorization/List of Reportable Items
SB 708-48	Cataloging Handbook H4/H8, Commercial and Government Entity (CAGE) Sections A & B

A-5. Other Publications

The Jewett Refrigerator Company, 2 Letchworth Street, Buffalo, NY 14213-1098.

PRF 116	Commercial Maintenance Manual
PRF 117	Commercial Operating Instruction Manual

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

a. This section provides a general explanation of all maintenance and repair functions, services, fault location/troubleshooting, removal/installation, and actions authorized at various maintenance levels.

b. Section II of this appendix designates authority and responsibility for the performance of maintenance functions on the identified end item or component. It also provides the work measurement time required to perform the function by designated maintenance levels. The application of the maintenance functions to the end item or component must be consistent with the capabilities and capacities of the designated maintenance levels, which are shown on the MAC in column (4) as—

(1) UNIT, which includes two subcolumns: C (operator) and O (unit maintenance).

(2) SUPPORT, which includes three subcolumns: F (direct support), H (general support), and D (depot-level support).

c. Section III of this appendix lists the tools and test equipment required for each maintenance function as referenced in section II of this appendix.

B-2. Maintenance functions

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination by sight, sound, or feel.

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, and/or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. To keep an item in proper operating condition (clean, preserve, drain, paint, or replenish fuel/lubricants/hydraulic fluids/compressed gas supplies).

d. Adjust. To maintain within prescribed limits by bringing into proper or exact position, or by setting the operating characteristics to specifications in this manual.

e. Align. To adjust specified variable elements of an item to optimum or desired performance.

f. Inspect/test electrical safety. To determine conformance to electrical safety parameters and make or report corrections.

g. Calibrate/verify/certify. To determine compliance of medical equipment with applicable specifications or standards and to make the necessary corrections. To compare the item with a certified device, tool, or test equipment standard.

h. Remove/install. To remove and then install the same item when required to perform service or other maintenance functions. Install may involve implacing, seating, or fixing into position an assembly, subassembly, module, or component to allow proper functioning of the end item.

i. Replace. To remove an unserviceable item and install a serviceable counterpart in its place.

j. Repair. To apply maintenance services, fault location/troubleshooting, removal/installation or disassembly/assembly procedures, and maintenance actions to identify troubles and to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, module, assembly, or end item.

k. Overhaul. To perform prescribed periodic maintenance in order to restore an item to a completely serviceable/operational condition as required by depot maintenance work requirements in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Normally, overhaul does not return an item to like-new condition.

l. Rebuild. To perform those services/actions necessary to restore unserviceable equipment to a like-new condition in accordance with the original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/components.

B-3. Explanation of columns in the MAC (section II)

a. Column (1), Group Number. This column lists functional group numbers. They are used to identify subassemblies, modules, and components with the next higher assembly.

b. Column (2), Component/Assembly. This column contains assemblies, subassemblies, modules,

and components for which maintenance is authorized.

c. Column (3), Maintenance Function. This column lists the functions to be performed on the item listed in column (2). Some items may be listed without maintenance functions; group numbers for these items coincide with other technical publications.

d. Column (4), Maintenance Level. This column specifies, by a work time figure (expressed as man-hours and shown as whole hours or decimals) the level of maintenance authorized to perform the function listed in column (3). The work time figure represents the average time required to restore an item (assembly, subassembly, module, or component) to a serviceable condition under typical field operating conditions. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures will be shown for each level. This time includes preparation time and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the authorized maintenance functions. Work time figures are displayed in the appropriate subcolumn(s). The symbol designations for the various maintenance levels are as follows:

C..... operator
O..... unit-level maintenance
F..... direct support maintenance
H..... general support maintenance
D..... depot-level maintenance

e. Column (5), Tools and Equipment (Eqpt). This column specifies, by code (sec III of this app), those common tool sets (not individual tools) and test equipment required to perform the designated function.

f. Column (6), Remarks. This column specifies, by code (listed in sec IV of this app), supplemental instructions and explanatory notes for a particular maintenance function.

B-4. Explanation of columns in tool and test equipment requirements (sec III)

a. Column (1), Reference Code. The tool and test equipment reference code correlates with the code used in section II, column (5).

b. Column (2), Maintenance Level. This column identifies the lowest level of maintenance authorized to use the tool set or test equipment.

c. Column (3), Nomenclature. This column lists the name of the tool set or test equipment.

d. Column (4), National Stock Number. This column identifies the national stock number (NSN) assigned to the specific tool set or item of test equipment.

e. Column (5), Line Item Number. This column shows the line item number (LIN) identified in SB 700-20.

B-5. Explanation of columns in remarks (sec IV)

a. Column (1), Reference Code. This column provides a code that correlates to the code used in section II, column 6.

b. Column (2), Remarks. This column contains supplemental information and explanatory notes pertinent to the maintenance function being performed as indicated in section II of this appendix.

Section II. MAINTENANCE ALLOCATION CHART FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT	(6) REMARKS
			UNIT		SUPPORT				
			C	O	F	H	D		
00	Refrigerator	Inspect	X	0.2					A,B
		Service	X	0.2				01,02	
		Test		0.2					
		Electrical Safety Test		0.3				01,02 03,05	
01	Seal, Non-metallic (Door Gasket)	Inspect	X	0.2					
		Replace		0.8				01,02	
02	Hinge	Inspect		0.2					
		Adjust		0.6				01,02	
		Replace		1.0				01,02	
03	Fastener (Latch)	Adjust		0.6				01,02	
		Replace		0.8				01,02	
04	Lamp	Replace		0.2					
05	Power Transformer	Test		0.2				03	
		Replace		0.5				01,02	
06	Main Switch	Test		0.2				03	
		Replace		0.5				01,02	
07	Ballast, Lamp	Test		0.2				03	
		Replace		0.5				01,02	
08	Switch Rotary	Test		0.2				03	
		Replace		0.3				01,02	
09	Switch, Door Ajar	Test		0.2				03	
10	Recording Thermometer	Test		0.5					E
		Repair		0.5				01,02	
		Replace		0.5				01,02	
		Calibrate		1.0				01,02	E

Section II. MAINTENANCE ALLOCATION CHART FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT	(6) REMARKS
			UNIT		SUPPORT				
			C	O	F	H	D		
101	Chart Drive	Test		0.5					
		Replace		1.0				01,02	
102	Thermal System	Test		0.5					
		Replace		1.0				01,02	
103	Pen	Service	X						
		Replace	X						
11	Temperature Monitor	Test		0.5				03	E
		Repair		1.0				01,02	
		Replace		0.5				01,02	
		Calibrate		1.0					E
111	Battery	Test	X						
		Replace	X						
112	Transformer	Test		0.2				03	
		Replace		0.1					
113	LED Red/Green	Test		0.2				03	
		Replace		0.3				01,02	
114	Switch, On/Off	Test		0.2				03	
		Replace		0.3				01,02	
115	Switch, Battery Test	Test		0.2				03	
		Replace		0.3				01,02	
116	Switch, Reset	Test		0.2				03	
		Replace		0.3				01,02	
117	Fuse	Test		0.2				03	
		Replace		0.3				01	

Section II. MAINTENANCE ALLOCATION CHART FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT	(6) REMARKS
			UNIT		SUPPORT				
			C	O	F	H	D		
118	Timer Assembly	Test		0.2				03	
		Replace		0.3				01,02	
119	Audible Assembly (Alarm)	Test		0.2				03	
		Replace		0.3				01,02	
1110	Switch, Rotary	Test		0.2				03	
		Replace		0.3				01,02	
1111	Switch, Push	Test		0.2				03	
		Replace		0.3				01,02	
1112	Main Board Assembly	Replace		0.5				01,02	
		Test			1.0			01,02 04,06 10,13	
		Repair			1.0			01,02 12	
		Replace			0.3			01,02	
12	Unit Cooler	Inspect	X						
		Repair		0.5				01,02	
		Replace		0.5				01,02	
13	Motor, AC	Replace		0.5				01,02	
14	Switch, Thermostatic	Test		0.3					
		Replace		0.5				01,02	
		Adjust		0.5				01	
15	Compressor Unit, Refrigeration	Inspect		0.3					
		Service				2.0		01,02 12	E
		Repair				3.0		01,02 12	E

Section II. MAINTENANCE ALLOCATION CHART FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT	(6) REMARKS
			UNIT		SUPPORT				
			C	O	F	H	D		
151	Motor, AC	Test Replace			0.5 1.0			03 01,02 12	E
152	Relay, Electromagnetic	Test Replace		0.2 0.3				03 01,02	
153	Capacitor, Fixed (Start)	Test Replace		0.2 0.3				03 01,02	
154	Filter Drier, Refrigerant	Replace			1.0			01,02 12	E
155	Heating Element	Test Replace		0.2 0.3				03 01,02	

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) REFERENCE CODE	(2) MAINTENNACE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) LINE ITEM NUMBER
01	O,F,H	Tool Kit, Medical Equipment Maintenance and Repair: Repairmans	5180-00-611-7923	W45334
02	O,F,H	Tool Kit, Medical Equipment Maintenance and Repair: Org Maint	5180-00-611-7924	W45197
03	O,F,H	Multimeter, Digital: AN/PSM45	6625-01-139-2512	M60449
		or AN/PSM45A	6625-01-265-6000	M60449
04	O,F,H	Multimeter, Digital Display: AN/USM-486	6625-01-145-2430	M23954
05	O,F,H	Tester, Current Leakage	6625-01-142-8233	T61791
06	O,F,H	Test Set, Electronic Circuit-Component	6625-01-217-7608	T77263
10	O,F,H	Oscilloscope, DC-100MHZ: AN/USM-488	6625-01-187-7847	P30693
12	F,H	Shop Equipment, Medical Maintenance: Depot Maint	4940-00-594-6455	T24386
13	O,F,H	Test Set, Semiconductor Device: TS-1836/U0	6625-00-138-7320	V91863

APPENDIX C

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. Introduction

C-1. Scope

This appendix lists expendable/durable supplies and materials that are required to maintain the equipment. This listing is authorization to requisition and retain the items if not otherwise authorized.

C-2. Explanation of columns

a. Column (1), Item Number. This number is sequentially assigned.

b. Column (2), Level. This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.

c. Column (3), National Stock Number. This is the NSN assigned to the item; use it to request or requisition the item.

d. Column (4), Description. This column indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the commercial and government entity (CAGE) code (formerly FSCM) in parenthesis followed by the part number.

e. Column (5), Unit of Measure (U/M). This column indicates the measure used in performing the actual operation or maintenance function. This measure is expressed by a two-character alphabetical abbreviation. If the unit of measure differs from the unit of issue, requisition the lowest unit of issue to satisfy the requirement.

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST
FOR
REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	O	7530-01-280-0613	Chart, Recording Instrument	EA
2	O	6810-00-264-6548	Glycerol, Technical	PT
3	O	4110-01-188-8056	Mark A Matic (Kit of Pens and a Pen Arm)	EA

APPENDIX D

REPAIR PARTS AND SPECIAL TOOLS LIST

Section I. INTRODUCTION

D-1. Scope

This manual lists spare and repair parts; special tools; special TMDE; and other special support equipment required for performance of unit-level, direct support, and general support maintenance. It authorizes the requisitioning and issue of spares and repair parts in consonance with the MAC (app B).

D-2. General

This appendix also contains the following sections.

a. Section II. Repair Parts List. A list of spares and repair parts authorized for use in the performance of maintenance. This list also includes parts which must be removed for replacement of the authorized parts.

b. Section III. Special Tools List. A list of special tools, special TMDE, and other special support equipment authorized for the performance of maintenance.

D-3. Explanation of columns in repair parts list (sec II)

a. Column (1), Item Number (No.). This number is sequentially assigned. When used in the narrative instructions of this manual, the item number will refer to this appendix.

b. Column (2), NSN and CAGE/Part Number. This column indicates the NSN on the upper line and the CAGE code and part number of the item on the lower line.

c. Column (3), Nomenclature. Indicates the Federal item name and/or manufacturer name of the spare or repair part.

d. Column (4), End Item Quantity (EI QTY). This column indicates the total quantity of the item contained in the unit.

e. Column (5), Unit of Issue (U/I). This column indicates the lowest unit of measure that can be requisitioned and issued. The measure is expressed by a two-character alphabetical abbreviation.

D-4. Explanation of columns in special tools list (sec III)

a. Column (1), Maintenance Level. This column provides codes that denote the applicable level(s) requiring the special tool identified in this manual.

b. Column (2), Required Quantity (Qty). This column identifies the required and authorized quantity of special tools at each maintenance level.

c. Column (3), NSN. This column identifies the NSN, when assigned. The NSN should be used for requisitioning.

d. Column (4), Nomenclature and/or Manufacturer Part Number. This column provides the name, identifying data, and manufacturer's reference number when an NSN is not assigned.

e. Column (5), CAGE. This column provides a 5-digit code listed in SB 708-48. This is a alphanumeric code assigned to each manufacturer or distributor of an item that enters the Federal cataloging system. When a stock-numbered item is listed, several manufacturers may provide the item; therefore, each one will have a different CAGE code (formerly Federal supply code for manufacturers (FSCM)).

Section II. REPAIR PARTS LIST FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) ITEM NO.	(2) NSN CAGE/PART NUMBER	(3) NOMENCLATURE	(4) EI QTY	(5) U/I
1.	6515-01-048-7725 59431/8300MRAC19	Protector, Thermal-Overload, Electric	1	EA
2.	5945-01-188-8053 32011/82632	Relay, Electromagnetic	1	EA
3.	5910-01-063-0517 59431/85PS110A75	Capacitor, Fixed, Electrolytic (Start Capacitor)	1	EA
4.	6105-01-178-4708 59431/810E006A65	Motor, Alternating Current	1	EA
5.	4140-00-343-7566 59431/51510	Impeller, Fan, Axial (Blade, Condensing Unit Fan)	1	EA
6.	4130-00-203-7596 95535/AE4440A	Compressor Unit, Refrigeration (Motor, Compressor)	1	EA
7.	6105-01-263-7234 14852/5021-S	Motor, Alternating Current (Unit Cooler Fan)	1	EA
8.	6105-00-869-7012 14852/5101B	Impeller, Fan, Axial (Blade, Unit Cooler)	1	EA
9.	14852/5054-D	Fan Guard	1	EA
10.	4130-01-280-1842 32011/71906003	Cooling Coil, Air, Duct Type (Finned Coil)	1	EA
11.	5930-01-234-6767 32011/CTL001	Switch, Thermostatic	2	EA
12.	4130-01-274-0221 32011/CPY001	Filter-Drier, Refrigerant	1	EA
13.	5325-01-189-3910 32011/2830-2110	Fastener & Strike Assembly, Door (Latch)	2	EA

Section II. REPAIR PARTS LIST FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) ITEM NO.	(2) NSN CAGE/PART NUMBER	(3) NOMENCLATURE	(4) EI QTY	(5) U/I
14.	5340-01-200-2272 87518/2842-1009-1110	Hinge, Non-Rise Adjustable	4	EA
15.	32011/SR1905-1	Shim, Hinge	4	EA
16.	5330-01-189-3907 32011/GKT014	Seal, Non-Metallic, Special Shaped (Gasket, Door)	2	EA
17.	32011/AR714-02A	Drawer, Slide Assembly	10	EA
18.	87518/22-51-SSA	Legs, Stainless Steel, Adjustable	4	EA
19.	32011/CHR002	Card Holder, Plastic	5	EA
20.	6640-01-279-9631 32011/BTL001	Bottle, Screw Cap	2	EA
21.	5930-01-189-3915 32011/780-021	Switch, Push	2	EA
22.	5930-01-189-3916 32011/780-022	Switch, Push	2	EA
23.	5930-01-279-2386 32011/SWT003	Switch, Rotary	1	EA
24.	4110-01-279-6453 32011/1102	Switch, Power	1	EA
25.	6250-01-279-2415 32011/8G1063W	Ballast, Lamp	1	EA
26.	6240-01-189-3913 32011/F40CW	Lamp (Fluorescent)	1	EA

Section II. REPAIR PARTS LIST FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) ITEM NO.	(2) NSN CAGE/PART NUMBER	(3) NOMENCLATURE	(4) EI QTY	(5) U/I
27.	87518/2776-1048-3000	Lamp Guard, Clear	1	EA
28.	4540-01-224-6033 32011/HTR001	Heating Element, Electrical, Immersion (Condensate Evaporator)	1	EA
29.	5950-01-280-1821 32011/TFR023	Transformer, Power	1	EA
30.	7640-01-187-7720 32011/M16-126-06	Chart Drive	1	EA
31.	32011/RDR027	Key, Winding, Chart Drive	1	EA
32.	32011/TFT013	Knob, Chart with Beaded Chain	1	EA
33.	32011/RDR006	Hub, Chart	1	EA
34.	32011/RDR044	Plate, Chart	1	EA
35.	4110-01-280-2929 32011/RDR005	Thermal System (-12 to +43 degrees Celsius)	1	EA
36.	32011/RDR003	Glass, Door	1	EA
37.	32011/RDR007	Screw, Micrometer Adjustment (Pen Arm)	1	EA
38.	32011/MOD-D0005	Timer Assembly	1	EA
39.	4110-01-279-4108 32011/MOD-D0006	Audible Assembly (Alarm)	1	EA

Section II. REPAIR PARTS LIST FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) ITEM NO.	(2) NSN CAGE/PART NUMBER	(3) NOMENCLATURE	(4) EI QTY	(5) U/I
40.	4110-01-279-9930 32011/MOD-D0003	Main Board Assembly	1	EA
41.	6685-01-279-4144 32011/MOD-D0008	Sensor, Temperature	2	EA
42.	4110-01-280-8160 32011/MOD-D0009	Cable Assembly, Temperature	2	EA
43.	4110-01-280-6452 32011/MOD-D0010	Plug Assembly, Door	1	EA
44.	6130-01-279-2398 32011/MOD-D0011	Power Supply	1	EA
45.	4110-01-279-6451 32011/MOD-D0001	Plug, Calibration, Blood	1	EA
46.	6515-01-279-2389 32011/MOD-D0012	Lens, Light (Red)	4	EA
47.	6515-01-279-2390 32011/MOD-D0013	Lens, Light (Green)	4	EA
48.	6135-00-700-2139 14832/522	Battery, 9 Volts DC	1	EA
49.	5980-01-051-1340 284801/HLMP-3502	LED, Green	4	EA
50.	5980-01-147-2406 284801/HLMO-3300	LED, Red	4	EA
51.	5930-01-051-8247 32011/7101SYCBE	Switch, Toggle (Battery Test)	2	EA
52.	5930-01-279-4142 32011/7105SYCQE	Switch, Push	1	EA

Section II. REPAIR PARTS LIST FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) ITEM NO.	(2) NSN CAGE/PART NUMBER	(3) NOMENCLATURE	(4) EI QTY	(5) U/I
53.	5930-01-279-4143 32011/MSPS-103C-2	Switch, Push (Door)	2	EA
54.	5920-01-189-3909 32011/900106	Fuse	1	PG

Section III. SPECIAL TOOLS LIST FOR REFRIGERATOR, MECHANICAL, BLOOD BANK

(1) MAINTENANCE LEVEL	(2) REQUIRED QTY	(3) NSN	(4) NOMENCLATURE MANUFACTURER PART NUMBER	(5) CAGE
O,F,H,D	1	4110-01-279-6451	Calibration Plug, MOD-D0001	30211
F,H,D	1	4130-00-990-6427	Manifold, Charging and Testing, Refrigeration	07295
F,H,D	1	4940-01-166-7059	Leak Detector, Refrigerant Gas	16734
F,H,D	1	4310-00-911-4754	Vacuum Pump Unit, Rotary	07295
O,F,H,D	1	6685-00-444-3000	Thermometer, Self-Indicating	81348

GLOSSARY

AC	Alternating current.
CAGE	Commercial and government entity.
Component/module	A combination of parts mounted together in manufacture, which may be tested, replaced as a unit, or repaired, (for example: monitor module, recorder, and fan). The term "module" is normally associated with electronic equipment.
C	Operator (maintenance).
D	Depot-level maintenance.
DC	Direct current.
DS	Direct support.
Disassembly/assembly	The step-by-step removal of parts from a module or end item to obtain access to a defective part for replacement and the subsequent step-by-step process of fitting the module or end item together.
ECU	Environmental control unit.
EI QTY	End item quantity.
Eqpt	Equipment.
F	Direct support maintenance.
Fault location/ troubleshooting	Investigating and detecting the cause of equipment malfunction; isolating a fault within a unit under test.
GS	General support.
H	General support maintenance.
Hz	Hertz (cycles per second).
ISO	International standards organization.
LED	Light emitting diode.
LIN	Line item number.
MAC	Maintenance allocation chart.
Maintenance actions	Welding, grinding, riveting, straightening, facing, remachining, and resurfacing an item of equipment.
Maintenance capability	Availability of those resources—facilities; tools; TMDE; drawings; technical publications; trained maintenance personnel; engineering and management support; spares; and repair parts required to perform maintenance operations.
Maintenance capacity	A quantitative measure of maintenance capability usually expressed as the number of man-hours of direct labor that can be applied within a specific maintenance activity or shop, during a 40-hour week (1 shift, 5 days).
Maintenance services	Inspecting, testing, servicing, adjusting, aligning, calibrating and/or replacing an item of equipment.
No.	Number.
NSN	National stock number.
O	Unit maintenance.
QA/QC	Quality assurance/quality control.
Qty	Quantity.
TMDE	Test, measurement, and diagnostic equipment.
U/I	Unit of issue.
U/M	Unit of measure.
V	Volts.
VAC	Volts alternating current.

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